DOCUMENT RESUME

ED 021 318 EA 001 450

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CHARACTERISTICS DIFFERENTIATING UNDER-AND OVERACHIEVING ELEMENTARY SCHOOLS.

National Center for Educational Statistics (DHEW), Washington, D.C. Div. of Data Analysis and Dissemination.
Report No- TN-63
Pub Date 12 Mar 68
Note- 47p.
EDRS Price MF-$0.25 HC-$1.96
Descriptors- ACADEMIC ACHIEVEMENT, ADMINISTRATOR BACKGROUND, CLASS SIZE, *ELEMENTARY SCHOOLS, FAMILY BACKGROUND, INSTRUCTIONAL MATERIALS, INSTRUCTIONAL STAFF, *OVERACHIEVERS, PARENT CHILD RELATIONSHIP, RACIAL FACTORS, *SCHOOL CONDITIONS, SCHOOL IMPROVEMENT, SCHOOL LOCATION, SCHOOL POLICY, SCHOOL SIZE, TEACHER CHARACTERISTICS, *UNDERACHIEVERS

The purpose of this study is to analyze overachieving and underachieving elementary schools in order to determine ways in which they differ. One hundred overachieving elementary schools across the nation were compared with 100 underachieving elementary schools. Questionnaires completed by sixth grade students, principals, and teachers of the respective schools were the chief sources of data. The report points out many dissimilarities between the two sets of schools in such areas as (1) parental interest, (2) instructional equipment, (3) class size, (4) staffing, (5) student background, (6) student ability and behavior, (7) school's reputation, and (8) teacher's race. No attempt was made, however, to directly specify causes of school quality differences because of the close correlations among the characteristics examined. (TT)

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CHARACTERISTICS DIFFERENTIATING UNDER- AND OVERACHIEVING ELEMENTARY SCHOOLS

by

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Technical Note

Number 63

March 12, 1968

EA 001 450
ED021318

OFFICE OF EDUCATION/U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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Preface

This report presents the preliminary results of a study being conducted by the Data Analysis Branch of the Division of Data Analysis and Dissemination of the National Center for Educational Statistics. The purpose of the study is to analyze overachieving and underachieving schools in order to determine the characteristics in which they differ. The report points out many dissimilarities between the two sets of schools; but it does not attempt, because of the correlations among the characteristics examined, to directly specify causes of school quality differences.

The study is part of the Center's continuing program of analysis of the data generated by the Equality of Educational Opportunity Survey.

Acknowledgments

A number of colleagues have contributed to the development of this study. Many thanks to Bruce Thompson, Murray Blum, and Esther Gist. Special thanks are due to Dr. Kenneth Tabler for suggesting the formula used to adjust school achievement differentials for school size. Without the assistance of automatic data processing a study of such magnitude would not have been possible.

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Characteristics Differentiating Under- and Overachieving Elementary Schools

1. Background and Purpose

The Equality of Educational Opportunity Survey was conducted during the fall of 1965 by the Office of Education in response to Section 402 of the Civil Rights Act of 1964. About 3400 schools participated in the Survey. Approximately 600,000 first, third, sixth, ninth, and twelfth grade pupils took standardized ability and achievement tests and provided socio-economic, attitudinal, motivational, and other personal data about themselves. All teachers in the participating schools, as well as the principals and superintendents, were asked to provide data characterizing both the schools and their own personal backgrounds. The teachers also were asked to take a 30-item test of their verbal facility.

The U.S. Office of Education report OE-38001, "Equality of Educational Opportunity," by James S. Coleman et al describes the Survey in detail, summarizes the information collected, and presents the results of some analyses of the data. Specifically the Survey addressed itself to four major questions, namely:

a. The extent to which racial and ethnic groups are segregated from one another in the public school.

b. Whether the schools offer equal educational opportunities in terms of specific criteria which are regarded as good indicators of educational quality.

c. How much students learn as measured by their performance on standardized achievement tests.

d. Possible relationships between students' achievement, on the one hand, and the kinds of schools they attend on the other.

The objective of this study described herein relates to the fourth of the above mentioned questions: it is to identify some overachieving and underachieving elementary schools and find the characteristics in which they differ. Knowing how they differ with respect to school characteristics should suggest why they differ with respect to achievement and indicate some steps that might be taken to improve the quality of the nation's elementary schools.

Section 2 of this study describes how school achievement was measured and how two lists, one of overachieving, the other of underachieving schools, were derived. Section 3 explains the method used to compare over- and underachieving schools. The results of the comparisons are presented in Section 4, and Section 5 states our plans for some additional related work.

2. Measurement of School Quality

The study's first goal was to generate two lists, one of some of the better, the other of some of the poorer elementary schools in the country. This meant we had to develop a measure of school quality. Since the impact of the quality of an elementary school should be cumulative--the longer a student is in a school, the greater effect the school has on his level of achievement--we decided to work with data for sixth grade students. For reasons expressed in Section 3.21 of the EEO Report, we used the student's scale score on the verbal ability test, a vocabulary test measuring verbal skills, as the criterion of achievement.1/ But the average level of achievement of the students in a school should not be taken as a measure of the school's quality. A child's scholastic achievement is highly dependent upon his background; it is the result of the social, economic, and home environment he has experienced as well as the school's influence. The EEO Report, in fact, states on page 325 that "Schools bring little influence to bear on a child's achievement that is independent of his background and general social context." Hence it is clear that in order to determine the effect of purely school-related factors on a child's achievement, we must find out how much better or worse he did in the achievement test than other children with similar backgrounds.

Sixth grade students answered over 50 questions designed to gather information about their home environment, their social and economic status, parental interest in their schooling, their attitudes, motivations, aspirations, and certain other facts (age, sex, etc.). The answers to these questions were used to calculate, by means of regression techniques, the expected verbal scores of almost 112,000 Survey students. Appendix A explains exactly how the expected (predicted) scores were determined and indicates the degree of precision attained in predicting scores.

For the purpose of this study, a student's achievement differential (d) is defined to be the algebraic difference between his actual and predicted verbal scale scores. A school's achievement differential (d) is defined to be the average value of the achievement differentials of the school's sixth grade students who provided useable data.

The student differentials were analyzed to determine to what extent they are more alike for students in the same school than they are for students in different schools. If we should find just as much variability among the d's of children in the same school as there is among students in different schools, our conclusion would be that there are no real differences among schools with respect to our measure of their quality; and there would be no point in proceeding any further in the study.

1/ The verbal ability test consisted of 50 multiple choice questions, 25 of the sentence completion type and 25 on synonyms. The data was normalized by transforming the number of correct answers to a scale score. The range of possible scale score values is 224 (0-7 correct) to 286 (50 correct).

The analysis of variance table below shows, however, that school quality differences do exist. The among and within school variance components are 4.99 and 66.50, respectively. The intraclass correlation coefficient (r), a measure of the degree of resemblance of d values within a school, is calculated from the variance components to be equal to .069.1/

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	Expectation of Mean Squares
Among Schools	717,251	2,391	300.0	$\sigma^2(w) + 46.8\ \sigma^2(a)$
Within Schools	7,288,714	109,598	66.5	$\sigma^2(w)$
Total	8,005,965	111,989		

Now the larger the number of students (n) that go into the calculation of $\bar{d}$ for a school, the greater reliance we have in $\bar{d}$ as reflecting the actual school achievement differential (δ). Also the larger the intraclass correlation (r), the greater the confidence we have in $\bar{d}$ as an estimate of δ. Therefore, we adjusted each school's $\bar{d}$ value for n and r by the below formula:2/

$$\text{adj. } \bar{d} = \bar{d}' = \bar{\bar{d}} + nr(\bar{d}-\bar{\bar{d}})/\{1+(n-1)r\},$$

where $\bar{\bar{d}} = 0.07$ is the grand mean of all d values.

We used $\bar{d}'$ as our measure of school quality, the higher the $\bar{d}'$ the better the school. The figure on the next page is a frequency distribution of $\bar{d}'$ values. The 2,392 schools were arrayed from high to low based on their $\bar{d}'$ values. Data pertaining to the top 100 schools and bottom 100 schools are listed in tables B-1 and B-2. We shall refer to these two sets of schools as "overachieving" and "underachieving" schools, respectively.

It should be noted here that d reflects only that part of school quality which is independent of the background of the individual student. The portion, if any, of school quality that is confounded with the student's own background serves only to increase (or decrease) the predicted score from what it otherwise would be. In other words if there is a tendency for children of higher level backgrounds to go to schools of better quality, on the average their predicted scores will be higher and their d values lower than if this

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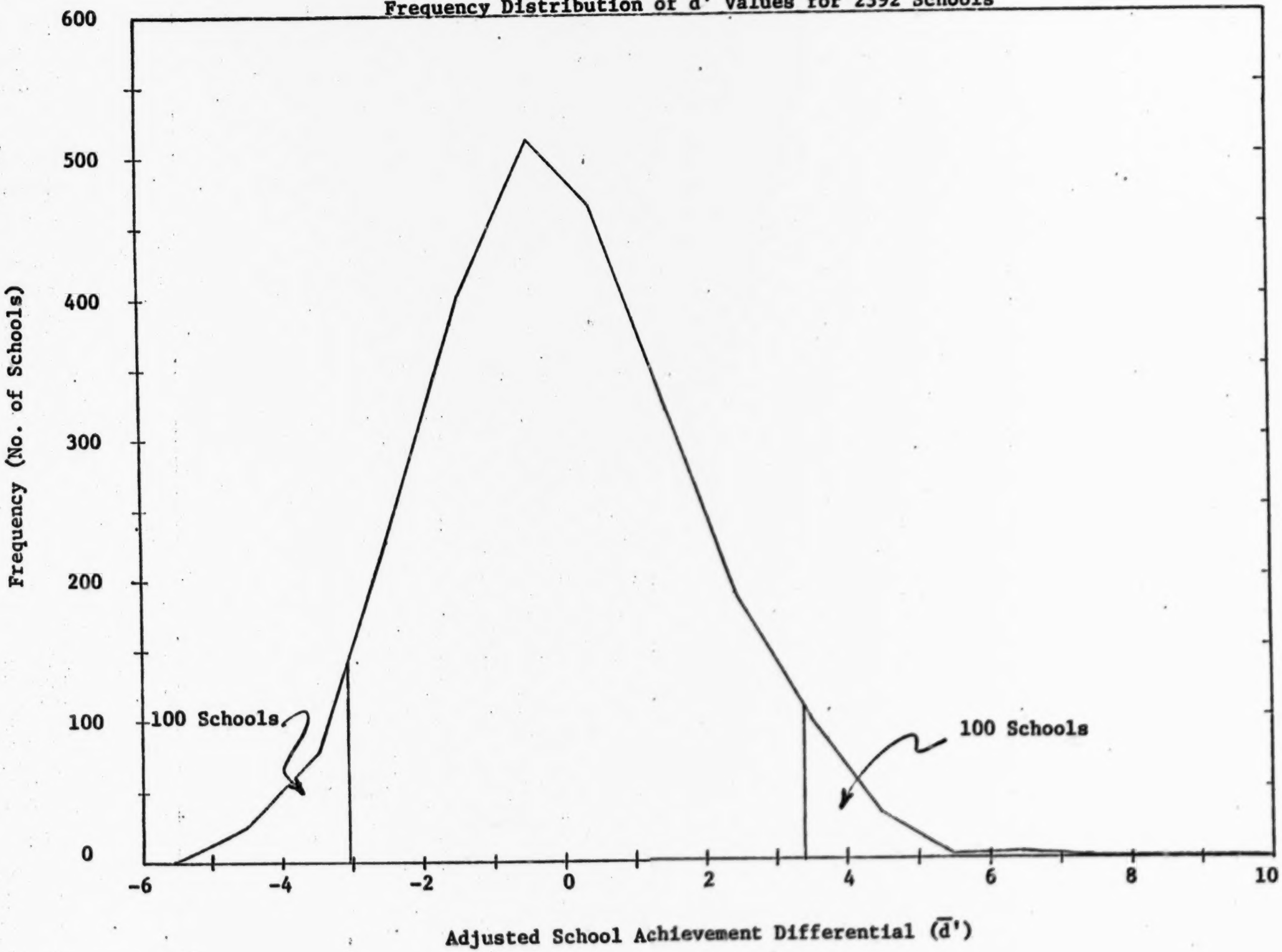
1/ See Statistical Methods for Research Workers by R. A. Fisher or Statistics in Research by B. Ostle for a discussion of the intraclass correlation coefficient.

2/ This formula may be derived by Sewall Wright's method of path coefficients; it is given on page 173 of Animal Breeding Plans (1947), by Jay L. Lush, Iowa State College Press, 3rd Edition.


Frequency Distribution of $\bar{d}'$ Values for 2392 Schools
Frequency (No. of Schools)
600
500
400
300
200
100
0
100 Schools
100 Schools
-6
-4
-2
0
2
4
6
8
10
Adjusted School Achievement Differential ($\bar{d}'$)

tendency does not exist. That is to say, this tendency, on the average, would cause d values of students from "good" backgrounds to underestimate school quality; and, conversely, d values of students from "poor" backgrounds generally would overestimate school quality. A student's predicted score is based only on his own background; it does not take into account the backgrounds of his classmates. The school environment as reflected by the backgrounds of his fellow students is considered to be a school factor and hence an aspect of school quality.

3. Method of Comparing Over- and Underachieving Schools

Identification of two sets of schools of vastly different effectiveness enables us to proceed to the problem of determining how under- and over-achieving schools differ.

The EEO Survey requested the principals and teachers of all participating schools to fill in questionnaires giving a wide variety of information about their personal backgrounds, the background and behavior of students in their schools, the resources and policies of their schools, their attitudes on school and racial issues, etc. These questionnaires were our main data source for comparing the 100 over- with the 100 underachieving schools. Except for certain questions more relevant to secondary than elementary schools, all questionnaire items were examined. The reader is referred to the questionnaires themselves for the exact wording of all questions asked.

For each relevant question, the number of principals (or teachers) giving each of the permissible answers to the question was determined separately for over- and underachieving schools. The two frequency distributions then were compared statistically to see whether we could conclude that there is a real difference between the two sets of schools in the pattern of responses to the question. Where all possible answers to a question could be ranked in a definite order (i.e., where the level of measurement was at least ordinal), a Kolmogorov-Smirnov test of significance was applied; otherwise (i.e., where the level of measurement was entirely or partially nominal) a Chi-square test of significance was used.1/ (In one instance a t-test was applied). In the former circumstance, a two-tailed test was employed; that is, we did not, prior to looking at the data, hypothesize a direction, higher or lower, of the distribution of over- as compared with underachieving schools.

The results of the comparisons of the two sets of schools with respect to data given in the Principal and Teacher questionnaires are presented in Sections 4.6 and 4.7, respectively. Prior to these sections, however, we examine (a) how school quality varies among the geographical regions of the country (Section 4.1), (b) the degree of uniformity of school quality within

1/ See, among others, S. Siegel's book Nonparametric Statistics for descriptions of these two statistical tests of significance.

school districts (Section 4.2), (c) the quality of Bureau of Indian Affairs schools (Section 4.3), (d) data on school size (Section 4.4), and (e) information on student backgrounds that is not provided in the Principal and Teacher questionnaires (Section 4.5). Section 4.8 summarizes our major findings regarding the characteristics that differentiate between over- and underachieving schools.

The reader is cautioned that all we can attempt in a study of this kind is to find characteristics in which over- and underachieving schools differ. Hopefully, the characteristics identified will suggest why some schools are better or worse than others. But the interpretation should not be made that because the two sets of schools differ significantly in some characteristic, a casual relationship has been proven with respect to this characteristics.

4. Findings

4.1. Comparisons of Geographical Regions

Of the 2,392 Survey schools having sixth grades, 1,132 (47.3%) have mean adjusted achievement differential (d') values greater than zero. The proportion of schools with positive d' values may be used as a measure of the quality of schools in a geographical region. It should be pointed out, however, that the schools in the Survey are not a simple random sample of the schools in a state or other geographical area. Schools in counties having high proportions of minority-group students were much more likely to have been included in the Survey than schools in counties having relatively few non-whites.1/

Regional comparisons of the proportion of schools with positive $\bar{d}'$ values may be made from the table on the next page. Schools in Standard Metropolitan Statistical Areas, as defined by the Bureau of the Census, are separated from those that are not. Considering SMSA schools, the lowest proportion (24%) occurs in the Far West and Rocky Mountain Region, the highest (75%) in the Plains. As for non-metropolitan schools, the Southeast has the lowest proportion (35%) with positive d' values, the Plains, again, the highest proportion (80%).

1/ For example, the probability of selecting a non-metropolitan county was .53 if the proportion non-white in the county was at least 70% but only .04 for counties with a proportion under 10% and fewer than 100 non-white students.

Region	SMSA Schools		Non-SMSA Schools		Total	
	With $\bar{d}'>0$	Total	With $\bar{d}'>0$	Total	With $\bar{d}'>0$	Total
I. New England	56 (68%)	82	11 (73%)	15	67 (69%)	97
II. Mid-Atlantic	146 (53%)	278	35 (45%)	78	181 (51%)	356
III. Great Lakes	106 (44%)	243	51 (70%)	73	157 (50%)	316
IV. Plains	42 (75%)	56	79 (80%)	99	121 (78%)	155
V. Southeast	90 (46%)	194	246 (35%)	713	336 (27%)	907
VI. Southwest	23 (38%)	61	99 (53%)	186	122 (49%)	248
VII. Far West & R. Mts.	37 (24%)	153	111 (69%)	161	148 (47%)	314
TOTALS	500 (47%)	1067	632 (48%)	1325	1132 (47%)	2392

The 100 schools with the lowest $\bar{d}'$ values (underachieving schools) and the 100 with highest $\bar{d}'$ values (overachieving schools) were chosen for an extensive comparison of their characteristics. Tables 1 and 2 of Appendix B list each school's $\bar{d}'$ value, actual and predicted mean verbal scale scores, standard deviation of the achievement differential (d) values of individual students, number of students with useable data, and proportion of these students who are non-white. The following table shows how the 200 schools are distributed among the seven geographical regions and between urban (SMSA) and rural (non-SMSA) areas. The distribution closely follows the pattern expected from the distribution of the 2392 schools shown in the preceeding regional table. New England and the Plains are represented by a total of 24 overachieving, but only three underachieving, schools. Almost half of the underachieving schools are in the Southeast as compared with only a quarter from this region in the overachieving group.

	Lowest 100 Schools			Highest 100 Schools		
	Rural	Urban	Total	Rural	Urban	Total
I. New England	0	3	3	3	9	12
II. Mid-Atlantic	1	16	17	3	17	20
III. Great Lakes	0	7	7	1	7	8
IV. Plains	0	0	0	8	4	12
V. Southeast	35	13	48	19	6	25
VI. Southwest	1	2	3	5	0	5
VII. Far West & R. Mts.	3	19	22	18	0	18
TOTALS	40	60	100	57	43	100

4.2. Clustering by School District

Tables B-1 and B-2 are characterized by clustering by school districts. To cite a few examples, the two least achieving schools by our criterion are in the same school district. A third school in this same district is 36th on the list of underachieving schools. Another school district is represented by seven underachieving schools, the 5th, 6th, 11th, 21st, 54th, 58th, and 77th on the list of 100. Less clustering by school district is apparent in the list of overachieving schools; but it may be noted, for example, that three of the top 25 are in the same school district.

To provide more information about school quality by school district, we organized and analyzed the d values of the 111,990 students on a school district basis. The analysis of variance table below shows how much of the total variation in student achievement differential values is due to school systems.

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	Expectation of Mean Squares
Among School Districts	409,813	595	688.76	$\sigma^2(w) + 186.98\ \sigma^2(a)$
Within School Districts	7,596,152	111,394	68.19	$\sigma^2(w)$
Total	8,005,965	111,989		

The within and among school district variance components are estimated to be 68.19 and 3.32, respectively. The intraclass correlation coefficient is .046. Based on this coefficient, the number of students, and the over-all mean achievement differential value (+.07), the adjusted mean achievement differential, was found by the formula given in Section 2 for each of the 596 school districts for which we have data. Table B-3 gives information, about the 50 districts having the highest d' values; Table B-4 does the same for the 25 school districts at the other end of the distribution.

4.3. Bureau of Indian Affairs Schools

Indian children attend public, Federal, private, and mission schools. In fiscal year 1965, of those enrolled in schools, 32.2% went to the 258 Federal schools operated by the Bureau of Indian Affairs (BIA).1/ The BIA provided boarding facilities for over half of the children attending their schools. Sixth grade students of 20 BIA schools participated in the Survey.

Two of the top ten achieving schools are BIA schools. Eight of the 20 BIA schools are in the upper decile. Only four have negative adjusted achievement differential values. Two of the top three school districts are BIA districts.

These results imply that Indian children enrolled in the BIA schools that were included in the Survey generally did better scholastically than Indian children of corresponding backgrounds in non-BIA schools.

1/ Source: "Fiscal Year 1965 Statistics Concerning Indian Education," Branch of Education, Bureau of Indian Affairs, U.S. Department of the Interior.

4.4. School Size

The major objective of this study is to find out in what ways over- and underachieving schools differ. One of the characteristics examined was size. The following table has frequency distributions by size, the number of sixth grade students for which we had useable data being our measure of size. We considered rural (non-SMSA) and urban (SMSA) schools separately because urban schools tend to be much larger than rural ones. For rural schools, there is no statistically significant difference in the size distributions of over- and underachieving schools. The size distributions of urban schools, however, differ at the .05 significance level, overachieving schools tending to be larger. Forty-two percent of the overachieving schools had at least 81 sixth graders with useable data as compared with only 12% of the underachieving schools.

Size	Rural			Urban		
	Under -	Over-	Total	Under-	Over-	Total
1-20	5	15	20	2	2	4
21-40	20	15	35	15	5	20
41-60	5	14	19	21	7	28
61-80	6	6	12	15	11	26
81-100	4	4	8	4	9	13
101-	0	3	3	3	9	12
Totals	40	57	97	60	43	103

4.5. Differences in Student Backgrounds

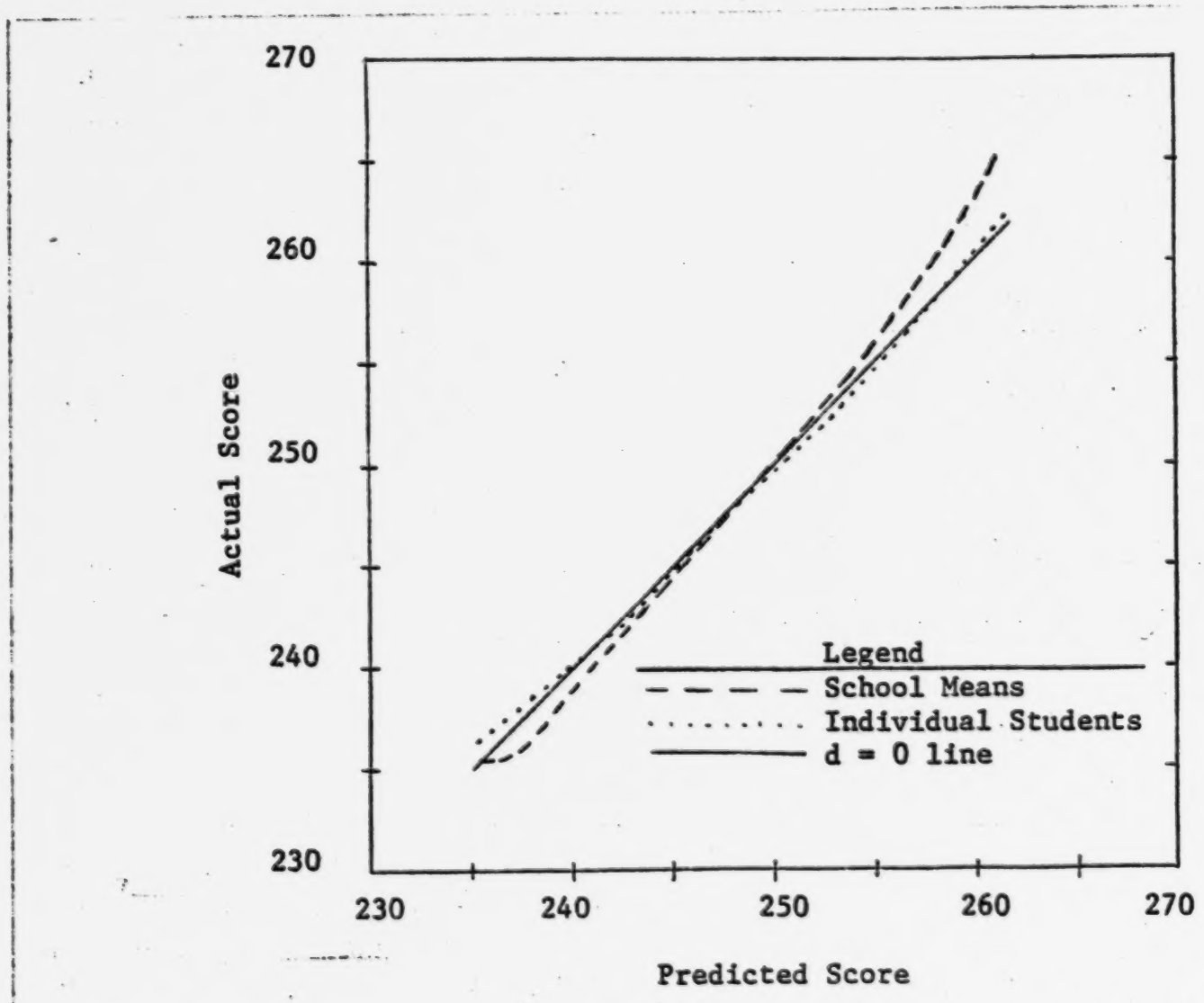
The verbal scale scores of students were regressed on a host of variables formed from questions about their backgrounds. (See Appendix A) Children from deprived backgrounds (e.g., poorly educated parents, minority groups, crowded homes, etc.) tend to do less well on scholastic achievement tests than children from more privileged backgrounds in the same school. Hence, they tend to have lower predicted scores, and we may use predicted score as an index of student background.

The following tables indicate that the 100 least-achieving schools in the Survey are to a large extent attended by disadvantaged and non-white children. In both cases the frequency distributions for under- and over-achieving schools differ significantly at the .001 level.

Predicted Mean Verbal Scale Score	No. of Schools	
	Underachieving	Overachieving
235.0-249.9	67	34
250.0-254.9	30	32
255.0-264.9	3	34
	100	100

Sixth Grade Proportion Non-white	No. of Schools	
	Underachieving	Overachieving
0-10%	18	43
10-90%	46	36
90-100%	36	21
	100	100

These results might at first appear paradoxical since we already had adjusted the data for the student's own background and developed separate prediction equations for whites and non-whites. That we have been fairly successful in adjusting test scores of individual students--at least to the extent that we may use predicted score as a measure of background--is shown by the closeness of the dotted line to the straight line in the figure below.



The expected value of d within the range covered by school means is essentially independent of predicted score. But when we collect individual students by the school attended and look at school means, we find a positive correlation between predicted achievement and achievement differential. This situation could arise only if students with high d values generally are found in the same group of schools and this group of schools tends to have student bodies of high level backgrounds and if students with low d values tend to be found in a different set of schools, schools that are attended in disproportionately large numbers by disadvantaged children.

It seems clear that a child of a given background tends to achieve at a higher level in a school composed primarily of students from "good" backgrounds than he does in a school having students mostly from "poorer" backgrounds and vice versa. But from this study we can not say to what extent, if any, the benefit is due to association with other students rather than to a positive correlation between student body background and intrinsic school quality.

Information provided by principals and teachers about the children in their schools is discussed in Sections 4.6.1 and 4.7.3.1.

4.6. Information Given by Principals

Due to non-response, data is available for only 93 of the 100 schools in each group; and of course, not all of the 186 principals answered all questionnaire items. Six of the underachieving schools with missing Principal questionnaires are in Region V (Southeast); the other one is in Region VII. Of the seven overachieving schools, one is in each of Regions I, II, V, and VI and three are in Region VII.

The following three sections discuss the results of our comparisons of the patterns of responses of the two sets of principals. Only those questionnaire items for which the patterns differed significantly are mentioned. A "D" denotes that the Kolmogorov-Smirnov test was used; and †, *, **, and *** mean that statistical significance was attained at the .10, .05, .01, and .001 levels, respectively. The results for questions where significance was found at only the .10 level, as well as at the more conventionally used significance levels, are shown because our purpose is to screen questionnaire items for suggested causes of school quality differences; and with the measurement levels involved, sample sizes of 93 do not provide much power for detecting small differences.

4.6.1. School Location and Student Background

The information below bears out our previous finding (see Section 4.5) regarding the differences in backgrounds of pupils attending the two sets of schools. Much more so than overachieving schools, underachieving schools are located in industrial suburbs or inner parts of large cities (28% vs. 2%) and to a lesser extent in rural areas (26% vs. 18%) rather than in smaller cities or residential areas of larger cities (46% vs. 80%). They are attended by high proportions of children of factory and other blue-collar workers (32% vs. 4%) rather than children of professional and white-collar workers (2% vs. 23%). Twenty-six percent of the underachieving schools are completely non-white; the comparable figure is 15% for overachieving schools; only 40% (vs. 61%) have at least 90% white students.

	Stat. Test	Proportion Under-Ach.		Over-Ach.
1. School located in industrial suburb or inner part of city over 50,000 (Q72)	χ^2	.28	***	.02
2. Most or all students of factory or blue collar workers (Q73)	χ^2	.32	***	.04
3. At least 90% of students are white (Q43)	D	.40	*	.61

4.6.2. Backgrounds of Principals

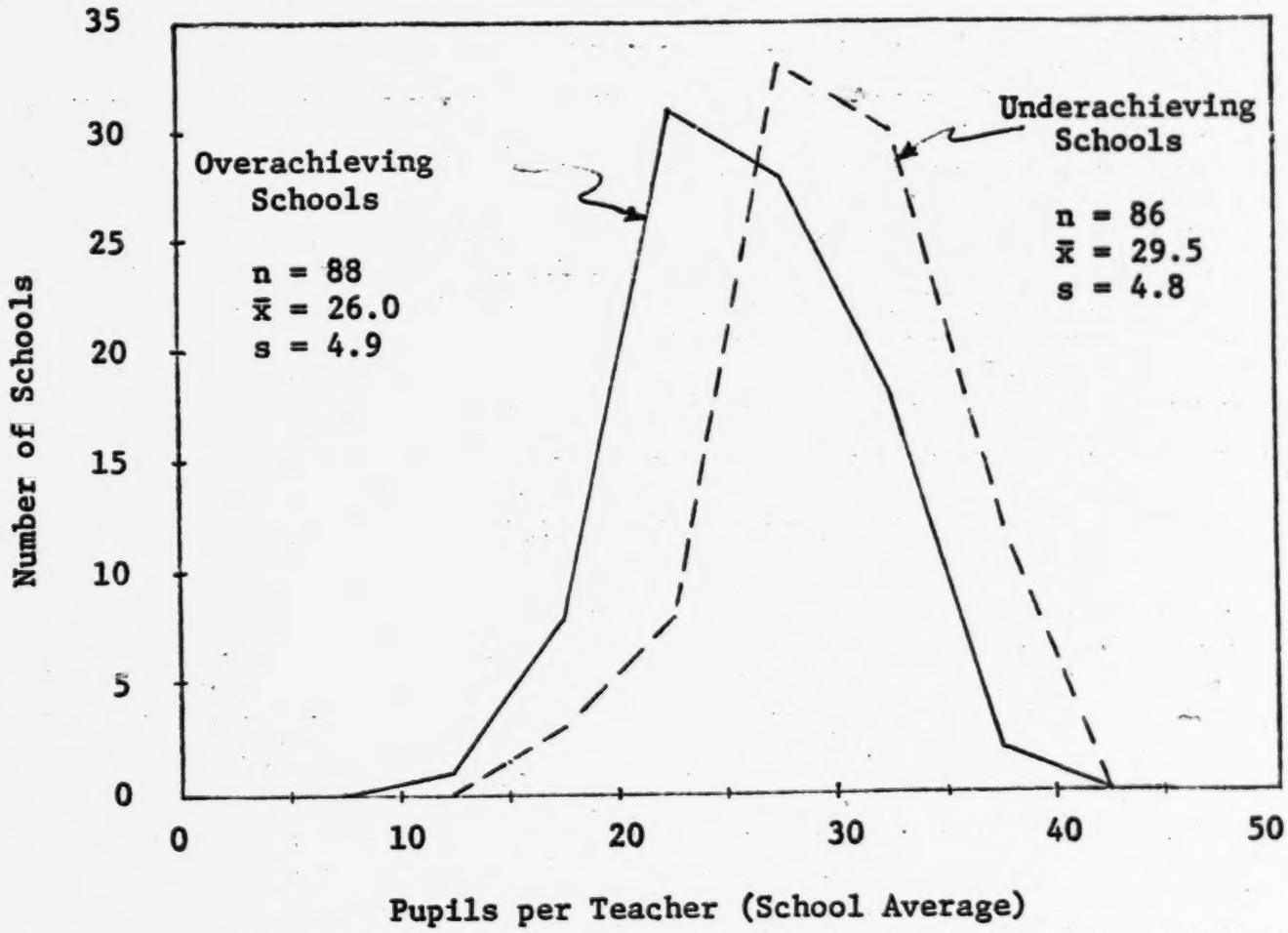
The personal backgrounds of the two sets of school principals differ significantly in these characteristics:

	Stat. Test	Proportion Under-Ach.		Over-Ach.
1. College attended was public-normal school or teachers college (Q62)	χ^2	.27	*	.45
2. College attended was at least 90% white (Q65)	D	.58	†	.78
3. Over 10 hr. credits beyond highest degree (Q66)	D	.49	†	.31

4.6.3. School Resources and Policies

Overachieving schools tend to have better resources. In comparison with underachieving schools, they are more likely to have larger school libraries, adequate numbers of textbooks, art and music teachers on at least a part-time basis, orchestra and/or bands (but not glee clubs and/or choruses) and smaller class sizes, an average of 13% fewer pupils per

teacher; but not as many of them offer foreign language courses or provide free textbooks. Pupil/Teacher ratio frequency distributions are plotted below.



(See Section 4.7.4 below for further data about classroom size)

Overachieving schools make more use of standardized achievement tests, are more likely to have an accelerated curriculum in at least one subject, tend to have slow learning pupils repeat grades in which they do failing work (52% vs. 28%) rather than promoting them with their age groups (35% vs. 58%), are more likely to be in school districts that have compulsory attendance laws, and expect the students to do less homework. The following table shows the daily amount of time sixth grade students themselves reported spending on homework. Comparatively speaking, students in overachieving schools tend to spend moderate amounts of time (1 or 1½ hr. per day) rather than small or large amounts of time doing homework.

Time (Hr.)	No. of Students Underachieving		Overachieving	
½ or less	2203	(37.6%)	1950	(32.0%)
1 or 1½	2356	(40.3%)	3043	(50.0%)
2 or more	1296	(22.1%)	1095	(18.0%)
	5855	(100.0%)	6088	(100.0%)

Of the 31 principals of overachieving schools who gave information about the percentage of students moving from one track to a higher track in the past year, only 13% of them reported a percentage of at least 10%. The comparable percentage for 22 underachieving school principals is 50%.

The table below summarizes our findings with respect to school resources and policies.

	Stat. Test	Proportion Under-Ach.		Over-Ach.
1. Library with at least 750 volumes (Q13b)	D	.57	*	.79
2. Library with at least 4 books per student (Q13b & 40)	D	.40	†	.61
3. Textbooks available in sufficient numbers (Q20)	χ^2	.81	**	.96
4. Textbooks are provided free (Q16)	χ^2	.92	†	.83
5. Art teachers - yes (Q30)	D	.22	***	.51
6. Music teachers - yes (Q31)	D	.54	*	.77
7. Pupil-Teacher Ratio-mean (Q26 & 40)	t	29.5	***	26.0
8. Foreign language courses offered (Q13n)	χ^2	.49	**	.26
9. Mental health problems referred to mental health clinics (Q33)	χ^2	.19	*	.37
10. Orchestra and/or band (Q90h)	χ^2	.63	**	.83
11. Glee club and/or chorus (Q90i)	χ^2	.76	**	.51
12. Standardized achievement tests given in at least 4 grades (Q23)	D	.48	**	.74
13. Accelerated curriculum provided in at least one subject (Q86)	D	.27	†	.47
14. Of schools with tracking, at least 10% of students moved to higher track in last yr. (Q84)	D	.50	†	.13
15. Homework - at least 1 hr. per day expected (Q91)	D	.44	†	.24
16. Promotion policy is slow learners repeat grade (Q89)	χ^2	.28	*	.52
17. Compulsory attendance law exists (Q7)	χ^2	.90	†	.98

4.6.4. School Reputation, Student Behavior, and Parental Interest

The principals of overachieving schools report that in their judgments the general reputations of their schools among educators in their areas is either among the best (53%) or better than average (34%) to a much greater extent than do principals of underachieving schools (only 37% and 28%, respectively). Student attendance is better in overachieving schools, and there are fewer problems with destruction of school property and discourtesy and impertinence to teachers in these schools. Of the schools that have PTA-type groups, parental interest, as reflected by attendance at the meetings of such groups, is considerably greater for overachieving schools.

	Stat. Test	Proportion Under-Ach.		Over-Ach.
1. Reputation among educators in area is above average (Q69)	D	.65	*	.88
2. Student attendance is at least 95% (Q42)	D	.47	*	.70
3. Destruction of school property is problem (Q48a)	D	.66	†	.47
4. Discourtesy and impertinence to teachers is problem (Q48b)	D	.58	*	.38
5. Of schools with PTA-type groups, meetings attended by only a few families (Q75)	D	.46	***	.11

4.7. Information Provided by Teachers

Only one of the 200 schools, a Southeast underachieving school, failed to return its Teacher questionnaires. A total of 1,806 questionnaires were received from teachers in underachieving schools, and 1,690 from teachers in overachieving schools. Some teachers (30% of those in underachieving schools and 26% of those in overachieving schools) reported that the lowest grade they taught was the 6th or a higher grade. It was not feasible to separate out these teachers, who have had no chance to directly influence the achievement of sixth graders. But it seems safe to assume that the quality of teachers and their opinions and attitudes as well, are quite uniform among grades within the same school.

Table 4.7-1 summarizes the results of the comparisons of the patterns of responses of the two sets of teachers for each questionnaire item. Because of the large number of teachers involved, fairly small differences can be statistically significant.

Table 4.7-1

Comparison of Answers Given by Teachers in Under- and Overachieving Schools

Question No.	Test of Significance	Proportion 1/ Under-	Over-	Answer
1	χ^2 = 19.7***	.232	.171	Sex is male
2	D = .095***	.687	.592	Age is under 46 yr.
3	D = .143***	.536	.394	Spent most of life in this county
4	χ^2 = 120***	.423	.527	Spent most of life in country or small town
5-6	χ^2 = 375***	.532	.839	Race is white
7	D = .128***	.452	.323	Graduated from H.S. in this county
8	χ^2 = 123***	.357	.518	Father's job was technical, official, mgrl., or farm mgr. or owner
9	D = .079***	.793	.872	Father finished grade school
10	D = .076***	.427	.503	Mother finished H.S.
11	D = .090***	.845	.754	Have Batchelors degree or less
12	χ^2 = 13.9***	.573	.635	Major undergrad. field was elementary education
13	χ^2 = 10.5**	.450	.506	Undergrad. college was public: normal or teacher
14	D = .081***	.802	.721	Highest degree offered was Master's or less
15	D = .120***	.274	.154	Undergrad. college is in this county
16	D = .335***	.410	.745	At least 90% of college students were white
17	χ^2 = 8.95**	.754	.708	In college was keen competition for grades
18	χ^2 = 20.9***	.458	.379	Freshmen took orders from upperclassmen
19	χ^2 = 0.666	-	-	Most students were of high academic caliber
20	χ^2 = 14.9***	.310	.249	Often discussed making money in college
21	χ^2 = 9.68**	.458	.405	Students were under pressure to get good grades
22	χ^2 = 0.047	-	-	Said hello to students didn't know
23	D = .062**	.773	.835	Rate college quality in nation's top 50%
24	D = .041	-	-	Credits beyond highest degree
25	D = .045†	.666	.621	Under 15 yr. total teaching experience
26	D = .023	-	-	Teaching experience in this school
27	D = .051*	.192	.141	Absent from work 7 or more days last year
28	D = .023	-	-	Type of state teaching certificate
29	χ^2 = 13.6***	.456	.520	Asked to work in this school
30	D = .017	-	-	Attended certain summer institutes
31	D = .044†	.180	.136	Attended program re teaching poor
32	D = .161***	.408	.569	Annual salary is over $6,000
33	D = .309***	.223	.532	Students rated exc. or good in how hard they tr
34	D = .339***	.213	.552	Students rated exc. or good in academic ability
35	χ^2 = 24.4***	.043	.015	Is sub. teacher on temporary assignment
36	χ^2 = 9.28**	.126	.163	Belongs to a national honorary society
37	D = .055*	.780	.835	Would re-enter teaching profession
38	D = .057**	.566	.623	Would rather not teach in different school
39	Omitted			
40	χ^2 = 26.5***	.096	.141	Prefer sch. with prof'l and white-collar childr
41	χ^2 = 55.8***	.518	.428	No preference re school's ethnic make-up
42	χ^2 = 180***	.322	.514	Prefer school with white student body
43	χ^2 = 30.1***	.198	.257	Prefer teaching high ability group classes
44	D = .246***	.522	.768	Think school's reputation is above average

Table 4.7-1 (cont.)

Comparison of Answers Given by Teachers in Under- and Overachieving Schools

Question No.	Test of Significance	Proportion 1/ Under-	Over	Answer
45	D = .304***	.307	.611	At least 90% of students taught are white
46a	D = .089***	.645	.734	Neighborhood elementary school should be kept regardless of racial imbalance
46b	χ^2 = 28.4***	.286	.335	Children should not be bussed other than to their neighborhood elementary school
46c	χ^2 = 1.63	-	-	Attitude toward compensatory education
46d	χ^2 = 23.0***	.206	.276	Non-white faculty best for non-white students
46e	χ^2 = 9.43*	.234	.214	Faculty for racially heterogeneous student body should be about half white
46f	χ^2 = 86.2***	.534	.725	White faculty best for white student body
47a	χ^2 = 348***	.741	.423	Home environment of students is bad
47b	χ^2 = 208***	.478	.237	Pupils are ill fed and clothed
47c	χ^2 = 37.0***	.120	.058	Racial or ethnic groups get along poorly
47d	χ^2 = 9.87**	.201	.248	Parents attempt interference with school
47e	χ^2 = 95.0***	.047	.148	Too much competition for grades
47f	χ^2 = 0.512	-	-	Too much emphasis on athletics
47g	χ^2 = 259***	.502	.232	Too many student absences
47h	χ^2 = 219***	.655	.399	Classes too large for effective teaching
47i	χ^2 = 74.2***	.244	.126	Students too much of one type
47j	χ^2 = 211***	.433	.197	Too much time must be spent on discipline
47k	χ^2 = 195***	.432	.203	Students aren't interested in learning
47l	χ^2 = 16.8***	.186	.133	Poor school admin. leadership
47m	χ^2 = 145***	.091	.250	Parents pressure students too much for good grades
47n	χ^2 = 36.1***	.118	.058	Teachers don't work well together
47o	χ^2 = 108***	.322	.165	Teachers have too little freedom in textbook selection, curriculum, and discipline
47p	χ^2 = 110***	.270	.122	Too much student turnover
47q	χ^2 = 385***	.677	.334	Parents don't take enough interest in children's school work
47r	χ^2 = 336***	.440	.147	Have poor instructional equipment
47s	χ^2 = 93.1***	.394	.236	Too many interruptions during classes
47t	χ^2 = 15.5***	.177	.127	Too much teacher turnover
47u	χ^2 = 2.79†	.049	.036	Too much turnover of administrators
48	D = .047*	.371	.324	Officer or active member of teachers' ass'n.
49	D = .059**	.822	.881	Read 2 or fewer ed. journals
50	D = .037	-	-	Plans to remain in public education
51	D = .023	-	-	Outside time spent in preparation
52	D = .017	-	-	Time spent in classroom teaching
53	D = .223***	.518	.741	Average of 30 or fewer pupils per class
54	Omitted			
55	D = .037	-	-	Time spent in counseling
56	Omitted			

Table 4.7-1 (cont.)

Comparison of Answers Given by Teachers in Under- and Overachieving Schools

Question No.	Test of Significance	Proportion 1/ Under-	Over	Answer
57	$\chi^2 = 42.1$***	.110	.067	Teaches all low ability groups
58	D = .060**	.888	.948	Lowest grade taught is 7th or less
59	D = .113***	.736	.849	Highest grade taught is 6th or less
60	$\chi^2 = 61.8$***	.329	.216	Negro students should be encouraged to aspire to jobs from which Negroes have been excluded in past
61	$\chi^2 = 32.6$***	.151	.229	Negroes better off going to Negro colleges
62	$\chi^2 = 3.13$†	.901	.920	Prefer teaching average ability students with strong interest in school achievement
63	$\chi^2 = 40.8$***	.916	.970	Do not spend any time on guidance counselor assignments
64-72	Omitted			

1/ For questions where the Kolmogorov-Smirnov test was used, the proportions shown are at the points at which the differences between the two cumulative frequency distributions are greatest. Where the Chi-square test was applied, the proportions stated are those believed to be most meaningful.

†, *, **, and *** indicate the attainment of statistical significance at (at least) the .10, .05, .01, and .001 levels, respectively.

4.7.1. The Teacher

4.7.1.1. Sex and Age. In overachieving schools, the proportion of male teachers is lower (17.1% vs. 23.2%) and the teachers are older (mean age of 41.2 vs. 38.9 yr.; 41 vs. 31% over 45 yr. old).

4.7.1.2. Family Background. The teachers in overachieving schools come from more advantaged backgrounds. Their parents are better educated (50.3% vs. 42.7% of their mothers finished high school and 87.2% vs. 79.3% of their fathers completed grade school), and their fathers had better jobs (51.8% vs. 35.7% reported their father's job was technical, official, managerial, or farm manager or owner). A higher proportion are white (83.9% vs. 53.2%). They and their families also have been less provincial (although 52.7% vs. 42.3% spent most of their life in a county or small town, 39.4% vs. 53.6% spent most of their life in the county they teach in, 32.3% vs. 45.2% graduated from a high school in the county where they are teaching, and 15.4% vs. 27.5% attended colleges in the same counties where they are teaching).

4.7.1.3. Education and Teaching Qualifications

a. College. In overachieving schools, the teachers have had more formal education (25.6% vs. 15.5% have at least a Master's degree) and reported they went to better colleges (83.5% vs. 77.3% said as undergraduates they went to colleges with academic rating in the top 50% among all the nation's colleges and 27.9% vs. 19.8% as undergraduates went to colleges offering more than a Master's). More (63.5% vs. 57.3%) majored in elementary education and more (50.6% vs. 45.0%) as undergraduates went to public normal schools or teachers' colleges. 74.5% vs. 41.0% as undergraduates went to colleges where at least 90% of the students were white. With respect to these colleges, fewer (70.8% vs. 75.4%) reported keen competition for grades, fewer (40.5% vs. 45.8%) said students were under pressure to get good grades, fewer (37.9% vs. 45.8%) reported freshmen had to take orders from upper classmen, and fewer (24.9% vs. 31.0%) said they often discussed making money with other students.

b. Teaching Qualifications. In overachieving schools, teachers had slightly more total teaching experience, (37.9% vs. 33.4% had taught at least 15 yr.). A smaller proportion (1.5% vs. 4.3%) are substitute teachers on temporary assignments, and a higher proportion (16.3% vs. 12.8%) belong to national honorary societies such as Kappa Delta Pi or Phi Beta Kappa.

c. Verbal Facility. Teachers were asked to take a 30-question test of verbal facility. Taking the test was entirely voluntary and the tests were not supervised. Teachers in overachieving schools on the average got 14% more correct answers (24.55 vs. 21.52).

4.7.2. His Salary. Teachers' pay is higher in overachieving schools. The average salary is 9.5% higher ($6,470 vs. $5,910 per year), and the proportion who earn over $6,000 per year is higher (56.9% vs. 40.8%).

4.7.3. The Students in His School

4.7.3.1. Their Backgrounds. Information given by teachers is consistent with our previously discussed finding (see Sections 4.5 and 4.6.1) that poor and minority group students are found in disproportionately large numbers in underachieving schools. More teachers in underachieving schools reported that the home environment of the students is not good (74.1% vs. 42.3%), that pupils are not well fed and well clothed (47.8% vs. 23.7%), and that less than 90% of their students are white (69.3% vs. 38.9%). More teachers in underachieving schools feel that the students are "all too much of one type." (24.4% vs. 12.6%)

4.7.3.2. Parental Interest. In overachieving schools, according to the teachers, parents (a) attempt to interfere with the school (24.8% vs. 20.1%), (b) put too much pressure on the students for good grades (25.0% vs. 9.1%), and (c) take enough interest in their childrens' school work (66.6% vs. 32.3%).

4.7.3.3. Ability and Behavior. In overachieving schools, more than twice as many teachers rated their students as excellent or good in their academic ability (55.2% vs. 21.3%) and in how hard they try in school (53.2% vs. 22.3%). In underachieving schools, a higher proportion of teachers feel that (a) the different races or ethnic groups don't get along well in his school (12.0% vs. 5.8%), (b) there are too many absences among students (50.2% vs. 23.2%), (c) there is too much student turnover (27.0% vs. 12.2%), (d) too much time has to be spent on discipline (43.3% vs. 19.7%), and (e) the students aren't really interested in learning (43.2% vs. 20.3%).

4.7.4. His School

4.7.4.1. Its Resources, Policies, and Administration. Three times as many (44.0% vs. 14.7%) teachers in underachieving schools thought they have poor instructional equipment (supplies, books, lab equipment, etc.). Teachers in underachieving schools

reported their average class sizes are larger (mean of 28.9 vs. 26.2 pupils, and 48.2% vs. 25.9% have over 30 pupils); and a larger number (65.5% vs. 39.9%) felt that their classes are too large for effective teaching. In underachieving schools, teachers are more likely to feel that (a) there is a lack of effective leadership from the school administration (18.6% vs. 13.3%), (b) the teachers don't seem to be able to work well together (11.8% vs. 5.8%), (c) they have too little freedom in such matters as textbook selection, curriculum, and discipline (32.2% vs. 16.5%), (d) there are too many interruptions during class periods (39.4% vs. 23.6%), and (e) there is too much teacher turnover (17.7% vs. 12.7%); but they are less likely to believe there is too much competition for grades (4.7% vs. 14.8%).

4.7.4.2. His Opinion of the School. In overachieving schools, more teachers (52.0% vs. 45.6%) had asked to be assigned to their school; and more teachers (62.3% vs. 56.6%) would rather not, if they could choose, change schools. Of those who felt they knew what the general reputation of their school was among teachers outside the school, more (76.8% vs. 52.2%) thought the reputation was at least better than average.

4.7.5. His Teaching

4.7.5.1. His Duties. In overachieving, a higher proportion reported that all their classes were high ability groups (6.6% vs. 2.9%); and a lower proportion said all their classes were low ability groups (6.7% vs. 11.0%).

4.7.5.2. Teaching Preferences. In overachieving schools a higher proportion of the teachers reported they preferred (a) to teach children of professional and white-collar workers (14.1% vs. 9.6%), (b) to teach in schools that have all or mostly white student bodies (51.4% vs. 32.2%), (c) to teach high ability groups (25.7% vs. 19.4%), and (d) to teach in schools that have mostly Anglo-Saxon students (42.0% vs. 32.4% of those with any preference).

4.7.5.3. Opinions About and Interest in Teaching Profession. In overachieving schools, 14.1% vs. 19.2% of the teachers said they were absent from work seven or more days; and 83.5% vs. 78.0% said if they could go back in time, in view of their present knowledge, they would still enter the teaching profession. But fewer (32.4% vs. 37.1%) were officers or active members in a teacher's association, and fewer (11.9% vs. 17.8%) regularly read three or more subject matter journals such as the NEA Journal, The Nation's Schools, The English Journal, etc.

4.7.6. Attitudes About School and Racial Issues. In overachieving schools, more teachers believe that with respect to elementary schools, neighborhood schools should be maintained regardless of any racial imbalance produced (73.4% vs. 64.6%) and children should not be bussed to a school other than their neighborhood school under any circumstances (33.5% vs. 28.6%). More also believe that an all or predominantly white faculty is best for an all or predominantly white student body (72.5% vs. 53.4%) but that an all or predominantly non-white faculty is best for an all or predominantly all non-white student body (27.6% vs. 20.6%). Fewer teachers in overachieving schools thought a teacher or guidance counselor should encourage Negro students to aspire to jobs from which Negroes have in the past been excluded (21.6% vs. 32.9%), and more believed that most Negroes would be better off going to Negro colleges (22.9% vs. 15.1%).

The results appear to indicate that teachers in underachieving schools tend to have what might be considered more liberal viewpoints on these issues. Bear in mind, however, the disparity in teachers' racial composition between the two sets of schools: 84% of the teachers in overachieving schools are white as compared to only 53% in underachieving schools.

4.8. Summary of Major Findings

Over- and underachieving schools were found to differ significantly with respect to many characteristics. Some of the differences, of course, are more pronounced than others. Among the largest ones are the following:

a. Parental Interest. In the opinions of principals and teachers, the parents of children in underachieving schools take comparatively little interest in either their childrens' school work or in the schools themselves. Over- and underachieving schools differ at least as much in this characteristic as any other characteristic examined. In underachieving schools more than twice as many teachers (68% vs. 33%) felt that "the parents don't take enough interest in their childrens' school work," and over four times as many principals (46% vs. 11%) of schools that have a parents' organization such as PTA, said that at a typical meeting "only a few" families of their students are represented.

b. Instructional Equipment. A second outstanding difference between the two sets of schools is in the quality and quantity of instructional equipment. In underachieving schools, three times

as many teachers (44% vs. 15%) said that they have "poor instructional equipment: supplies, books, laboratory equipment, etc.", and over four times as many principals (19% vs. 4.4%) indicated that the textbooks used in instructional programs were not available in sufficient numbers. Further inadequacy in underachieving schools is indicated by the smallness of their school libraries: 43% vs. 21% have under 750 volumes.

c. Class Size. Teachers in underachieving schools generally have more students per class. Data provided by principals indicates that there were 13% more pupils per teacher in under- than in overachieving schools; data given by teachers shows the average class size was 10% larger in underachieving schools. In addition, many more teachers in underachieving schools (66% vs. 40%) thought that their classes are "too large for effective teaching."

d. Art and Music Teachers. The two sets of schools differ appreciably in the availability of art and music instruction. Underachieving schools are less likely to have an art teacher (22% vs. 51%), music teacher (54% vs. 77%), and an orchestra or band (63% vs. 83%) although they are more likely to have a glee club or chorus (76% vs. 51%).

e. Student Background. The answers to a variety of questions asked of principals and teachers all indicate that underachieving schools are attended in disproportionately large numbers by culturally and economically disadvantaged children. Teachers reported that the "home environment of the students is not good" (74% vs. 42%) and that the "pupils are not well fed and well clothed" (48% vs. 24%). Principals indicated that their schools were attended by all or mostly children of factory and blue-collar workers (32% vs. 4%) and are located in rural areas, industrial suburbs, or inner parts of large cities (54% vs. 20%). According to the teachers, 58% of the pupils in underachieving schools were non-white as compared with only 32% in overachieving schools.

f. Student Ability and Behavior. In the opinions of their teachers, pupils in underachieving schools rate low in how hard they try (78% vs. 47% said average or less) and in their academic abilities (79% vs. 45% rated them as average or less). They also are not interested in learning (43% vs. 20%), are absent too often (50% vs. 23%), and require too much time to be spent on discipline (43% vs. 20%).

g. School's Reputation. Three times as many principals (35% vs. 12%) and twice as many teachers (48% vs. 23%) in underachieving schools think that the general reputation of their school among educators outside the school is only average or below.

h. Teacher's Race. In underachieving schools, three times as many of the teachers were non-white (47% vs. 16%). This is a higher ratio than might have been expected from the proportions of non-white students (58% vs. 32%).

Appendix A

Regression Analysis Details

A.1. Source of Predictor Variables

The Sixth Grade Student Questionnaire has 54 questions. We omitted three of them (Q31, 43, and 50) because they relate more to the student's school and its policies than to the student himself. Other questionnaire items concern the student's opinions, attitudes, and actions. Although his answers to such questions may be somewhat influenced by the quality of the school he attends, they undoubtedly depend mostly on non-school factors. Hence all other questionnaire items were used to derive predictor (independent) variables for the regression model.

Three questions (Q4, 5, and 6) identify the student's race or ethnic group. For the purpose of this study, these three questions were combined into one question with seven answers possible. He was classified as Puerto Rican if he replied "Yes" to Q5, Mexican-American if he said "No" to Q5 and "Yes" to Q6, or as White, Negro, American-Indian, Oriental, or Other based on his answer to Q4, if he replied "No" to both Q5 and Q6. Students failing to answer these questions were put in the "Other" category.

A.2. Separate Regressions for Whites and Non-whites

Examination of the EEO Report and preliminary analysis of our own indicated that the effects of some variables are not the same for whites and non-whites. The limitation on the number of regression coefficients we can estimate (see Section A.3), however, precludes use of a regression model having an adequate number of interaction terms. We, therefore, decided to develop two separate prediction equations, one for whites, the other for non-whites, using an interaction -free model for both groups. (Oriental-Americans were included with whites since their test scores are more like those of whites than those of Negroes or other minority groups).

A.3. Formation of Regression Variables

The available computer programs for regression analysis limit the number of coefficients that can be estimated to fewer than 80. If we formed one prediction variable from each question and used only the linear terms of the variables in the regression model, only 49 coefficients would have to be estimated. Fewer than a dozen of these questions, however, contain natural numerical scales in their answers; and verbal scale score

was suspected to be non-linear with respect to some of these (e.g., time watching TV). The vast majority of the items involve measurements at only the nominal (e.g., race) or ordinal (e.g., how good a student are you?) level. The best way of handling such questions is to form (k-1) dummy (artificial) variables from each question that has k possible answers. But this would require the estimation of many more coefficients than we can handle computationally. (The total number of answers over all 49 questions is 251). Consequently, we applied several techniques, as described below, singly and in combination, to keep the number of terms in the regression model under 80. Each technique involves loss of information and hence possible loss of predictive precision in the resulting regression equation.

(a) Form an artificial numerical scale by assigning numbers to each possible answer, preferably in such a way that the response (verbal score), when adjusted for all other variables in the model, will be linear. This approach often was taken for questions involving measurement at the ordinal level, that is, where the answers had a natural ranking. We thus were able to reduce the number of regression coefficients from (k-1) to one, if we were satisfied that our scale would result in a nearly linear relation.

(b) Combine questions that to a great extent are measuring the same factor or omit one or more of several highly correlated questions. For example, one question asks "How good a student does your mother want you to be in school?" Another asks for the same information about the father. Since the replies to these questions are highly correlated, they were combined into an index after assigning numerical values to the various answers that could be given to the questions.

(c) Collapse answer classes into a smaller number of sets. For example. a student may give one of eight possible answers to the question "Who acts as your father?" Combining the six answers stepfather, fosterfather, grandfather, other relative, other adult, and no one, reduces the number of variables required for this question from seven to two. This method is especially useful for questions involving nominal scales where similar scores are expected for students giving any of several possible answers and/or the proportions of students giving certain answers are very small.

Tables A-1 and A-2 identify the variables that were formed from the questionnaire items and show how they were scaled. The model for white students has 76 predictor variables,one of which is for race; the model for non-white students has 79, four of which are for race. There are many instances in which variables could have been formed or scaled differently;

it is doubtful that any two persons would agree completely on these matters. This study was concerned with the regression equation solely as a way to predict a student's verbal score, however, and not with interpretations of the many individual regression coefficients. If one were interested primarily in the meanings of the regression coefficients as estimates of the individual effects of various factors on student achievement, a different approach to formation of variables than taken here would be more appropriate; and different interpretations could well result from forming variables in different ways. Predictive ability, however, seems to be little affected by changes in the way variables are formed or scaled as long as we are fairly reasonable about how we do it. The insensitivity of predictive precision is indicated by the results of two other regressions that were run on the same data. Subsequent to the original regression, tables became available which gave the mean composite achievement score of the students giving each possible answer to each questionnaire item. This information was used to develop for comparative purposes, two additional pairs of regression equations. In one case, a criterion scaling[1/] approach was used wherever possible; in the other, the same type of approach as used originally was taken, but with many differences in variable definitions and scaling. Both yielded equations having practically the same predictive precision as the original pair.

A.4. Regression Sample

An 8% systematic sample consisting alternately of every 12th and every 13th sixth grade student in the survey was taken in order to estimate the regression coefficients. There were 10,011 students (5543 white, 4468 non-white) in the sample. A total of 1053 (10.52%) of them, however, were excluded from the regression calculations for the following reasons.

A.4.1. Low Verbal Scores. In the sample 39 white and 322 non-white students had the lowest possible scale score of 224. These students answered correctly only seven or fewer of the 50 verbal test questions. This group of 361 low scoring students failed to answer an average of 24 of the verbal test questions, whereas all other white (non-white) students failed to answer on the average only 4½ (1½) questions. These 361 students were excluded from the regression calculations since their low scores seem to reflect more a failure to take the test than an indication of their true verbal abilities.

A.4.2. Non-response to Questionnaire Items. Those students failing to answer any of the three questions regarding race and ethnic group were classified racially as "Other." We felt that the ability to

1/ See OE Technical Report No. 8, Criterion Scaling by Albert E. Beaton, dated April 25, 1967.

predict a student's verbal score might be substantially lessened if over 10% of his other background information were missing. Hence, students failing to answer five or more of the remaining 48 questionnaire items were omitted from the regression calculations. There were 169 (523) such white (non-white) students among those still in the 8% sample. This left 5335 (3623) students for use in the regression calculations. Non-responses to particular questionnaire items among these students were handled as follows: (a) for numerically scaled variables, the mean value of those students who did reply was substituted for all those who did not, and (b) for dummy variable type questions, non-respondents were treated as having answered the question in the manner indicated in Table A-2.

A.5. Regression Results

Regression coefficients were estimated one at a time by the forward step-wise procedure. All variables through the last step at which the coefficient of the added variable was statistically significant from zero at the .05 level were retained in the prediction model. Table A-3 shows the estimated values of the regression coefficients. It should be kept in mind that the purpose of the regression equations was solely to obtain predictions of verbal scale scores. Individual regression coefficients themselves may have little meaning because of inter-correlations among predictor variables.

A.5.1. Precision of Predictions

The analysis of variance table below shows that a highly significant portion (about 40%) of the variability in verbal scale scores of each group, whites and non-whites, is attributable to the regression equation. Of the total variation among all students regardless of race, all but 44.7% is accounted for by the two equations.

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio
Whites				
Due to Regression	291,772 (40.7%)	52	5611.00	69.61***
Residual	425,790 (59.3%)	5282	80.61	
Total	717,562	5334	134.53	
Non-whites				
Due to Regression	110,606 (38.0%)	67	1650.83	32.47***
Residual	180,730 (62.0%)	3555	50.84	
Total	291,335	3622	80.43	
Combined				
White vs. Non-white	348,484 (25.7%)	1	348,484.	
Due to Regression	402,378 (29.6%)	119	3381.33	49.27***
Residual	606,520 (44.7%)	8837	68.63	
Total	1357,382	8957	151.54	

***-Statistically significant at .001 level.